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BOOK REVIEWS

Edited by DAVID I. STEINBERG

The Book Review Section is a regular feature of *COMPUTERS & MATHEMATICS with applications*. Reviews are invited of books which are of particular interest to the Journal's readers. A review should ordinarily not exceed two typed (double spaced) pages, and should be approximately 70–50% descriptive and 30–50% evaluative in nature. Manuscripts of reviews as well as books submitted for review should be sent to: Prof. David I. Steinberg, Dept. of Mathematical Studies, Southern Illinois University, Edwardsville, IL 62026.

The Heat Equation by D. V. WIDDER. Academic Press, New York, 1975. 267 pp. $22.50

This is a long-awaited book from one of the most important contributors to what might be termed the Theory of Heat Functions—in somewhat of an analogy to the Theory of Complex Functions. It is *not* a book for those who would wish to consult it to solve, for instance, various boundary value problems for the heat equation; nor for those who are looking for generalizations involving nonconstant coefficients, nonlinearities, or the like.

We have here, essentially, a beautifully arranged condensation of the author's (and of his associates' and students') work during the past few decades, relating to the theory of the one dimensional heat equation

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$$

While this theory has its obvious physical origins, and indeed one of Widder's earliest published papers, 'Positive Temperatures on an Infinite Rod' (1944) has also a satisfying physical content besides its mathematical importance, the book nevertheless does not concern itself with physical background. Instead, its principal thrust is to develop a theory of those functions which are solutions of the heat equation in various regions of the x–t plane.

An essential part of this development is to establish the necessary connections between these solutions and Laplace, Weierstrass or more general convolution transforms. Included here are things such as representation theorems, considerations of analyticity, solutions of integral equations (inversion of transforms), addition theorems for solutions, and the like.

Bounded and positive temperature functions play a prominent role in the development, and two chapters of the book are devoted to them. These and the previously mentioned subject seem to culminate, in Chapter X, in the subject of series expansions of temperature functions. It is this chapter which, in some ways, seems to be the most fundamentally important for the book; for it gives the analogy of expanding classes of solutions of the heat equation in series which have their counterparts in the theory of a complex variable as Laurent series.

Many other subjects are covered in this book. Theta functions, the Huygens property, Appell transformation, higher dimensions and homogeneous temperature functions are only a few that we could mention.

The book's written in the elegant style one has learned to expect from Widder: concise statements, logical development and excellent readability. Since the material in it, in many places, consists of simplified versions of results which appeared earlier in research papers, it is accessible to anyone with a good grasp of only complex function theory. No other background is assumed; either physical or mathematical.

This book can be recommended very highly to any serious student of the heat equation; and indeed, to anyone who wishes to have an excellent self-contained account of this equation.

Washington University
St. Louis, Missouri 63130

ERVIN Y. RODIN

Mathematics and Computers in Archaeology. By J. E. DORAN and F. R. HODSON. Harvard University Press, Cambridge, Massachusetts, 1975. 381 pp. $18.00.

With *Mathematics and Computers in Archaeology*, J. E. Doran and F. R. Hodson have made an exceedingly useful and important contribution to the discipline. This book is a thoroughly competent and readable elucidation of the use and misuse of mathematics and computers in archaeology. At a more philosophical level, the authors present an interesting and important general viewpoint on their subject.

Of the three parts of the book, the first is devoted to a lucid and complete development of the mathematical concepts needed to understand the subsequent discussion of archaeological data analysis. The second part is the heart of the book, wherein important topics in archaeological data analysis are explained and evaluated. In the third and final part of the book, the authors survey and comment on some current ideas in the mathematical analysis of archaeological data.